

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Appl. No. : 10/518,127 Confirmation No.: 6723
Appellants : Gong et al.
Filed : July 25, 2005
For : Functionalized Elastomer Nanocomposite
TC/Art Unit : 1796
Examiner : Pepitone, Michael F.
Docket No. : 2002B094/2

APPELLANTS' BRIEF UNDER 37 CFR 41.37

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants appeal to the honorable Board of Patent Appeals and Interferences the
Final rejection of the claims as set forth in the Office Action mailed September 15, 2008.

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I. REAL PARTY IN INTEREST

The real party in interest is ExxonMobil Chemical Patents Inc, the assignee of the present application.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' counsel, and the assignee of the application are not aware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-3, 5, 9, 10, 11, 14, 16, 19, 20, 22, 23, 29-32, 36-38, 40, 42, 45, and 73-74 are pending.

Claims 4, 6-8, 12-13, 15, 17, 18, 21, 24-28, 33-35, 39, 41, 43-44, and 46-72 are cancelled.

Claims 1-3, 5, 9, 10, 11, 14, 16, 19, 20, 22, 23, 29-32, 36-38, 40, 42, 45, and 73-74 are appealed.

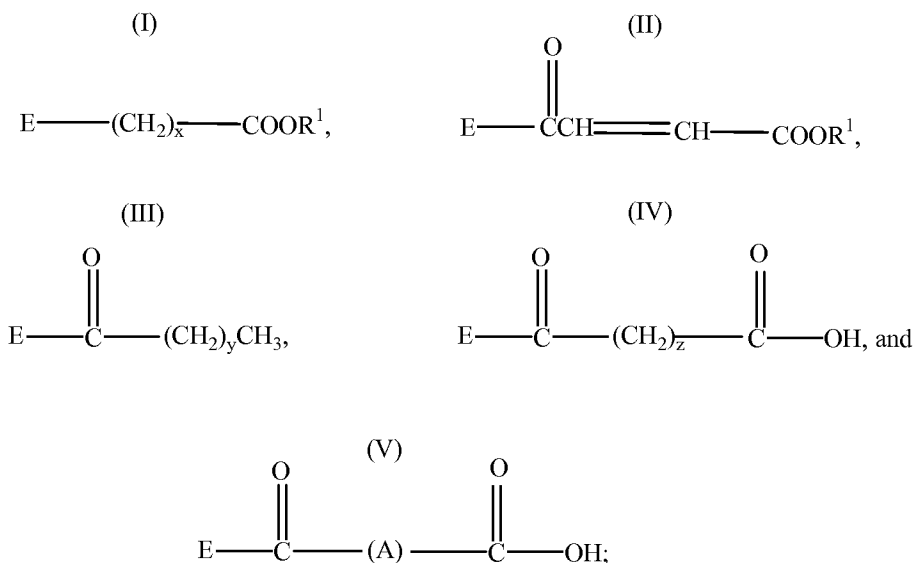
IV. STATUS OF AMENDMENTS

The amendment after final, filed by Applicants on 12 November 2008 was entered for purposes of appeal. No further amendments have been submitted. There are no outstanding amendments.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. The invention recited in independent claim 1 relates to a nanocomposite comprising clay and an elastomer.

The elastomer is comprised of C₂ to C₁₀ olefin derived units (pg 3, lines 11-13). The elastomer also comprises functionalized monomer units described by the following groups (I), (II), (III), (IV) and (V) pendant to the elastomer E (pg 3, lines 14-17):



wherein R¹ is selected from hydrogen, C₁ to C₂₀ alkyls, alkenyls or aryls, substituted C₁ to C₂₀ alkyls, alkenyls or aryls (pg 3, lines 18-19). The value of x ranges from 0 to 20 (pg 3, lines 19-20). The value of y ranges from 0 to 20 (pg 4, line 1). The value of z ranges from 1 to 20 (pg 4, lines 1-2). In the monomer units, the "A" is an aryl group, which may or may not be substituted (pg 4, lines 3-4).

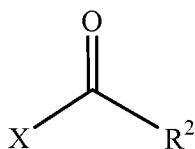
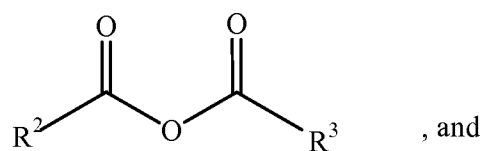
The clay has been treated with an exfoliating agent to form an exfoliated clay (pg 11, lines 20-22).

The nanocomposite has a permeation coefficient of less than 7 mm·cc/(m²·day·mmHg) at 40° C (pg 33, lines 1-2).

B. The invention recited in independent claim 22 is directed to a method of forming a nanocomposite comprising clay and an elastomer.

The method comprises contacting clay treated with an exfoliating agent, an elastomer, a grafting promoter, and at least one functionalizing compound (pg 29, lines 1-4). The

elastomer comprises C₂ to C₁₀ olefin derived units (pg 29, lines 3-4). The functionalizing compound is selected from the group consisting of CO₂,



wherein R² and R³ are the same or different and are selected from hydrogen, C₁ to C₁₀ alkyls, alkenyls and aryls, hydroxyl, and C₁ to C₁₀ alkoxy, wherein R² and R³ may form a ring structure; and wherein X is selected from hydroxyl, halides, and alkoxy groups (pg 23, lines 1-9).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether all pending and appealed claims are unpatentable as obvious under 35 U.S.C. 103(a) over Elspass et al (US 5,807,629) in view of Patil (US 5,498,673) when taken with Li et al. (US 6,060,549).

VII. ARGUMENT

Rejection under 35 U.S.C. § 103(a) over Elspass in view of Patil when taken with Li et al

Though presented as separate rejections in the Final Office Action, all pending article claims and all pending method claims stand finally rejected under almost identical rejections under 35 U.S.C. 103(a) as being obvious over Elspass et al (US 5,807,629) in view of Patil (US 5,498,673) when taken with Li et al. (US 6,060,549).

Appellants respectfully traverse the rejection and request the Board to consider the following arguments.

Elspass teaches the formation of nanocomposites comprising an elastomer and a layered material dispersed therein (col 2, lines 9-10). The preferred elastomers are isobutylene containing copolymers (col 2, lines 11-17). The isobutylene copolymer may be functionalized with halogenated paramethyl styrene (col 2, lines 27-32). The layered material is a swellable layered clay capable of having the clay layers further separated (col 2, lines 33-44). The clay can be treated with swelling agents by contacting the clay with hydrocarbyl onium salts in either a liquid or a melt dispersant (col 2, lines 45-48).

The relative proportions of the clay and the elastomer will vary “depending upon the intended use of the composite” (col 2, lines 64-67), but typical composites will contain 0.1 wt% to not more than 80 wt% of the clay (col 3, lines 3-7). The composite is prepared by melt blending in a mixer under conditions to achieve clay packets having an average thickness of 10 nm to about 140 nm (col 3, lines 10-15).

The elastomer/clay composite may be further blended with a “solid rubber” to lower the viscosity and enhance processability of the composite (col 3, lines 32-36). All of the “solid rubbers” taught by Elspass are butyl based elastomers (col 3, lines 42-46), presumably to maintain the desired air impermeability characteristics of the elastomer forming the composite.

In both the Office Action of February 21, 2008 and the Final Office Action of September 15, 2008, the failure of Elspass to teach functionalizing the elastomer with any of the recited Groups I-IV, or the functionalized compounds is acknowledged. To remedy this deficiency, the teachings of Patil are applied.

Patil is directed to the improvement of the bonding and grafting ability of isobutylene rubbers by functionalizing a styrenic moiety of the isobutylene polymer. The highly saturated backbone of the isobutylene provides good air permeability and environmental

resistance but limits the bonding/grafting ability of the polymer (col 1, lines 10-18). To functionalize the copolymer, Patil teachings adding a functional group (col 1, lines 45-57), via grafting of acid anhydrides, acylhalide or lactone (col 2, lines 19-22), to the benzene ring of the alkylstyrene group (see chemical structures in columns 1 and 2 and claim 1). As stated by Patil, the goal of the invention is to enable the acid functionalized polymer to be “co-reacted or compatibilized with other polymers by grafting techniques” (col 1, lines 22-25) and used in forming polymer blends such as reacting the functionalized polymer with “polyol, polyamines or the like” (col 1, lines 58-61).

In both the February 2008 Office Action and the September 2008 Final Office Action, it was held that both Elspass and Patil are concerned with “the preparation of copolymers of isoolefins and functionalized para-alkylstyrenes” and that it would have been obviousness to combine the copolymers of Patil in the invention of Elspass as Patil “suggests that such groups have particular utility in forming polymer blends and is an equivalent alternative means of providing copolymers of isoolefins and functionalized para-alkylstyrenes” (2/21/08 Office Action, pg 6; 9/15/08 Office Action, pg 3). In the Advisory Action of November 2008, this argument is expounded upon by noting that Elspass discloses that a solid rubber is blended with the nanocomposite material, and it would have been obvious to use to copolymer of Patil for the solid rubber of Elspass since the copolymer of Patil has “particular utility in forming polymer blends” (Advisory, pg 2-4).

Applicants respectfully disagree with these holdings.

Elspass is *not* “concerned with the preparation of copolymers of isoolefins and para-alkylstyrenes” as asserted. Elspass is directed to the formation of a nanocomposite; specifically, achieving sufficient disassociation of the clay layers to achieve a fine dispersion of the clay in the polymer (col 1, lines 16-22; col 1, lines 61-67). Elspass discloses in both the list of potentially useful elastomers (col 2, lines 11-14) and in the examples the use of elastomers that are not copolymers of isoolefins and para-alkylstyrenes. Furthermore, other than stated a preference for halogenating the paramethyl styrene, Elspass does not provide any further teachings with regard to the preparation of the copolymer. To assert that Elspass sets forth such a concern is overreaching and reading teachings into Elspass that simply do not exist.

It is continually stated that the copolymer of Patil has “particular utility in forming polymer blends.” However, the “blends” as taught by Patil differ from the nanocomposite and the elastomer mixtures of Elspass. Patil teaches that the functionalized copolymer is

useful for *co-reacting*, or compatibilizing, with other polymers via grafting (col 1, lines 24-26), noting in particular *reacting* the functionalized copolymer, as a compatibilizer, with polyol, polyamines, or the like (col 1, lines 58-61) and the exemplary *reaction* of the polymer with an alcohol (col 4, lines 22-48). The copolymer of Patil is intended to be *reacted* with a different type of compound; not simply blended into an elastomeric mixture as suggested by the rejection.

In the rejections, it is oft repeated that the copolymer of Patil is “an equivalent alternative means of providing copolymers of isoolefins and functionalized para-alkystyrenes.” Applicants disagree. The prior art compounds of Patil are the halogenated paramethyl-styrene isobutylene copolymer. Patil, in teaching to functionalize the copolymer, is inherently stating that the prior art copolymer is not an equivalent to the taught functionalized copolymer; but instead, the copolymers of Patil have a greater reactivity with other compounds. Thus, one skilled in the art would not expect the copolymer of Patil to behave equivalent to the copolymers of Elspass.

Due to the often unpredictable nature of chemical reactions and grafting, with the more reactive copolymer of Patil, when combined with the onium salt swelling agent in the clay of Elspass, there is no certainty that there will not be any undesirable reactions between the functional group and the onium salt. Contrary to the assertions in the rejection, the copolymer of Patil will not function as an “equivalent alternative” solid rubber.

Elspass teaches that the solid rubber is added to lower viscosity and enhance processability of the composite material. There is nothing in Patil that would suggest that the copolymer of Patil would serve these desired goals. The contrary is actually suggested by the greater reactivity of the copolymer of Patil; if the copolymer is more reactive, greater bonding will likely increase the viscosity of the polymer. The desired lack of any functionality is evident in Elspass’ list of taught solid rubbers.

The inventive nature of Applicants’ recited invention is that, surprisingly, using a highly functionalized copolymer with acid and/or ester functionalities, creating a more hydrophilic elastomer, exfoliation of the nanoclay is significantly improved and provides for a nanocomposite of enhanced impermeability characteristics due to the greater exfoliation. Again, due to the often unpredictable nature of chemical reactions and grafting, one skilled in the art would not have expected to achieve the level of success by using an isobutylene copolymer functionalized with acid and esters to improve a nanocomposite.

Li is cited as providing evidence that using a treated clay provides for greater dispersion of the exfoliated layers in the polymer matrix. However, the swelling agents disclosed by Li appear to be simply cumulative of the onium salts already disclosed by Elspass. Furthermore, Li is directed to a thermoplastic elastomer that includes a thermoplastic resin that provides the compound with thermoplastic properties – something not disclosed or taught by either Elspass or Patil. Thus, Li is not analogous to either Elspass or Patil, is merely cumulative to Elspass, and provides no teaching or suggestion that acid or ester functionality of the elastomer by will result in an improved nanocomposite as recited by Applicants.

To establish *prima facie* obviousness, there 1) must be some suggestion or motivation in the art to modify or combine the references; 2) must be a reasonable expectation of success and 3) the combined references must teach or suggest all the claim limitations. *Graham v. Deere*.

Herein, for the reasons stated above, there is no suggestion or motivation in the art to combine, the references are not related to solving a common problem, and there is no reasonable expectation of success based upon the references cited in the pending rejections. *Prima facie* obviousness has not been established by the above rejection of the pending claims.

Accordingly, it is respectfully requested that the rejection under 35 USC §103(a) over Elspass et al (US 5,807,629) in view of Patil (US 5,498,673) when taken with Li et al. (US 6,060,549) be withdrawn.

Appellants respectfully submit that the foregoing arguments obviate all of the Examiner's final rejections in this case. The cited references neither disclose nor suggest the presently claimed invention. In view of this, reversal of these rejections by the Honorable Board is respectfully requested.

Respectfully submitted,

17 February 2009

Date

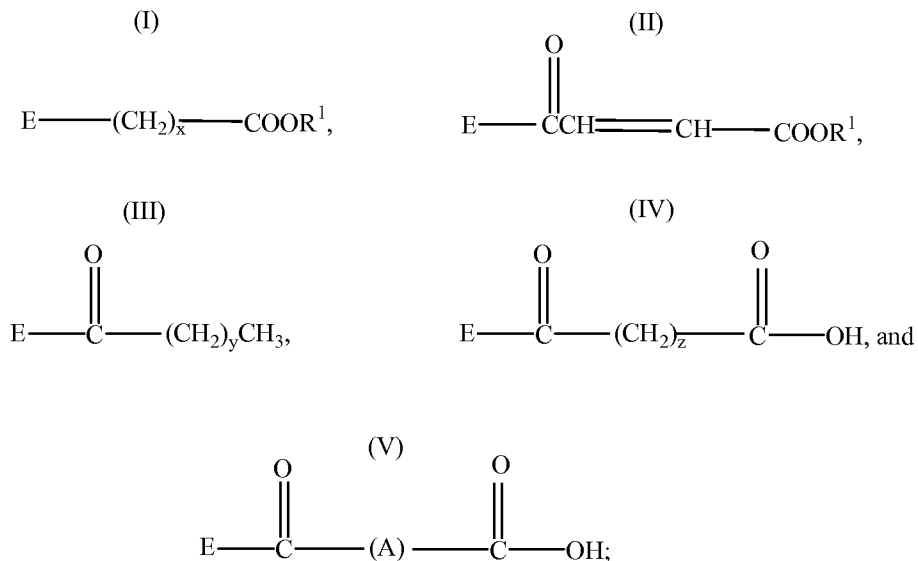
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CLAIMS APPENDIX

1. (Previously Presented) A nanocomposite comprising clay and an elastomer comprising C₂ to C₁₀ olefin derived units; wherein the elastomer also comprises functionalized monomer units described by the following groups (I), (II), (III), (IV) and (V) pendant to the elastomer, E:

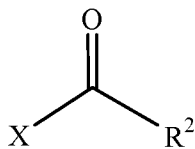
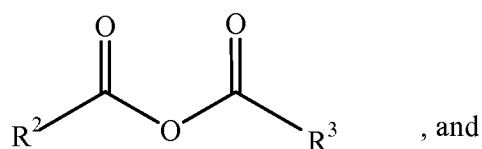


wherein R¹ is selected from hydrogen, C₁ to C₂₀ alkyls, alkenyls or aryls, substituted C₁ to C₂₀ alkyls, alkenyls or aryls; wherein the value of x ranges from 0 to 20; and wherein the value of y ranged from 0 to 20; and wherein the value of z ranges from 1 to 20; and wherein "A" is an aryl group, either substituted or not wherein the clay has been treated with an exfoliating agent to form an exfoliated clay and wherein the nanocomposite has a permeation coefficient of less than 7 mm·cc/(m²·day·mmHg) at 40° C.

2. (Original) The nanocomposite of Claim 1, wherein the elastomer also comprises monomer units selected from styrenic derived units and substituted styrenic derived units.
3. (Original) The nanocomposite of Claim 2, wherein the styrenic units are functionalized.

4. (Cancelled)
5. (Original) The nanocomposite of Claim 1, wherein the olefin is selected from one or more of isobutylene, isobutene, isoprene, cyclopentadiene, 2-methyl-1-butene, 3-methyl-1-butene, 2-methyl-2-butene, and 4-methyl-1-pentene, ethylene, propene, 1-butene, 1-hexene, and 1-octene.
6. - 8. (Cancelled)
9. (Original) The nanocomposite of Claim 1, wherein the elastomer also comprises multiolefin derived units.
10. (Original) The nanocomposite of Claim 1, wherein the elastomer is selected from any one or a mixture of natural rubber, poly(isobutylene-*co*-isoprene), polybutadiene, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene), poly(styrene-isoprene-butadiene), star-branched polyisobutylene rubber, poly(isobutylene-*co-p*-methylstyrene), ethylene-propylene-alkylstyrene rubber, ethylene-propylene-styrene rubber.
11. (Original) The nanocomposite of Claim 1, wherein the functionalized units are present on the elastomer from 0.01 wt% to 15 wt% of the elastomer.
12. -13. (Cancelled)
14. (Original) The nanocomposite of Claim 1, wherein the clay is present from 0.1 wt% to 50 wt% of the nanocomposite.
15. (Cancelled)
16. (Original) The nanocomposite of Claim 1, also comprising a filler selected from carbon black, modified carbon black, silica, precipitated silica, and blends thereof.

17. – 18. (Cancelled)
19. (Original) The nanocomposite of Claim 1, also comprising a secondary rubber selected from natural rubber, polybutadiene rubber, nitrile rubber, silicon rubber, polyisoprene rubber, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene) rubber, styrene-isoprene-butadiene rubber, ethylene-propylene rubber, brominated butyl rubber, chlorinated butyl rubber, halogenated isoprene, halogenated isobutylene copolymers, polychloroprene, star-branched polyisobutylene rubber, star-branched brominated butyl rubber, poly(isobutylene-*co*-isoprene) rubber; halogenated poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene rubber and mixtures thereof.
20. (Previously Presented) An article comprising the nanocomposite of Claim 1, the article being a tire innerliner or an innertube.
21. (Cancelled)
22. (Previously Presented) A method of forming a nanocomposite comprising contacting clay treated with an exfoliating agent, an elastomer, a grafting promoter, and at least one functionalizing compound, wherein the elastomer comprises C₂ to C₁₀ olefin derived units and wherein the functionalizing compound is selected from the group consisting of CO₂,



wherein R^2 and R^3 are the same or different and are selected from hydrogen, C_1 to C_{10} alkyls, alkenyls and aryls, hydroxyl, and C_1 to C_{10} alkoxy, wherein R^2 and R^3 may form a ring structure; and wherein X is selected from hydroxyl, halides, and alkoxy groups.

23. (Previously Presented) The method of Claim 22, wherein the method of contacting comprises one of the following methods: 1) the elastomer is first contacted with the functionalizing compound, followed by contacting with the clay, 2) the elastomer, clay, and acid functionalizing compound are contacted simultaneously, and 3) the elastomer and functionalizing compound are melt blended wherein the nanocomposite has a permeation coefficient of less than $7 \text{ mm}\cdot\text{cc}/(\text{m}^2\cdot\text{day}\cdot\text{mmHg})$ at 40° C .

24. - 28. (Cancelled)

29. (Previously presented) The method of Claim 22, wherein the functionalizing compound is selected from the group consisting of succinic anhydride, maleic anhydride, phthalic anhydride, glutaric anhydride, citraconic anhydride, itaconic anhydride, and other cyclic anhydrides, succinyl chloride, glutaryl chloride, itaconyl chloride, malonyl chloride, adipoyl chloride, diethylmalonyl dichloride, 3-methyladipoyl chloride, pimeloyl chloride, suberoyl chloride, azelaoyl chloride, sebacoyl chloride, isophthaloyl dichloride, phthaloyldichloride, and terephthaoyl chloride.
30. (Original) The method of Claim 22, wherein the elastomer also comprises monomer units selected from styrenic derived units and substituted styrenic derived units.
31. (Original) The method of Claim 22, wherein the olefin is selected from one or more of isobutylene, isobutene, isoprene, cyclopentadiene, 2-methyl-1-butene, 3-methyl-1-butene, 2-methyl-2-butene, and 4-methyl-1-pentene, ethylene, propene, 1-butene, 1-hexene, and 1-octene.
32. (Original) The method of Claim 30, wherein the styrene derived units are present from 1 to 15 wt% of the elastomer.

33. – 35. (Cancelled)
36. (Original) The method of Claim 22, wherein the elastomer is selected from any one or a mixture of natural rubber, poly(isobutylene-*co*-isoprene), polybutadiene, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene), poly(styrene-isoprene-butadiene), star-branched polyisobutylene rubber, poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene-alkylstyrene rubber, ethylene-propylene-styrene rubber.
37. (Original) The method of Claim 22, wherein the elastomer is functionalized by contacting with the functionalizing compound, wherein the functional groups are present on the elastomer from 0.01 wt% to 15 wt% of the elastomer.
38. (Previously Presented) The method of Claim 22, wherein the clay has been treated with an exfoliating agent to form an exfoliated clay wherein the exfoliating agent is selected from ammonium ion, alkylamines, alkylammonium ion (primary, secondary, tertiary and quaternary), phosphonium or sulfonium derivatives of aliphatic, aromatic or arylaliphatic amines, phosphines and sulfides and blends thereof.
39. (Cancelled)
40. (Original) The method of Claim 22, wherein the clay is present from 0.1 wt% to 50 wt% of the nanocomposite.
41. (Cancelled)
42. (Original) The method of Claim 22, also comprising a filler selected from carbon black, modified carbon black, silica, precipitated silica, and blends thereof.
43. - 44. (Cancelled)

45. (Original) The method of Claim 22, also comprising a secondary rubber selected from natural rubber, polybutadiene rubber, nitrile rubber, silicon rubber, polyisoprene rubber, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene) rubber, styrene-isoprene-butadiene rubber, ethylene-propylene rubber, brominated butyl rubber, chlorinated butyl rubber, halogenated isoprene, halogenated isobutylene copolymers, polychloroprene, star-branched polyisobutylene rubber, star-branched brominated butyl rubber, poly(isobutylene-*co*-isoprene) rubber; halogenated poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene rubber and mixtures thereof.

46. - 72. (Cancelled)

73. (Previously Presented) A tire innerliner comprising the material made by the method of claim 22.

74. (Previously Presented) An innertube liner comprising the material made by the method of claim 22.

EVIDENCE APPENDIX

No evidence is being presented.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.